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Simmons

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(54) **BIT HEAD RETAINING SYSTEM AND METHOD OF INSTALLING A BIT HEAD IN A PERCUSSION DRILL**

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(52) **U.S. Cl.** **175/57**; 175/415
(58) **Field of Search** 175/300, 414, 175/415, 57; 173/132

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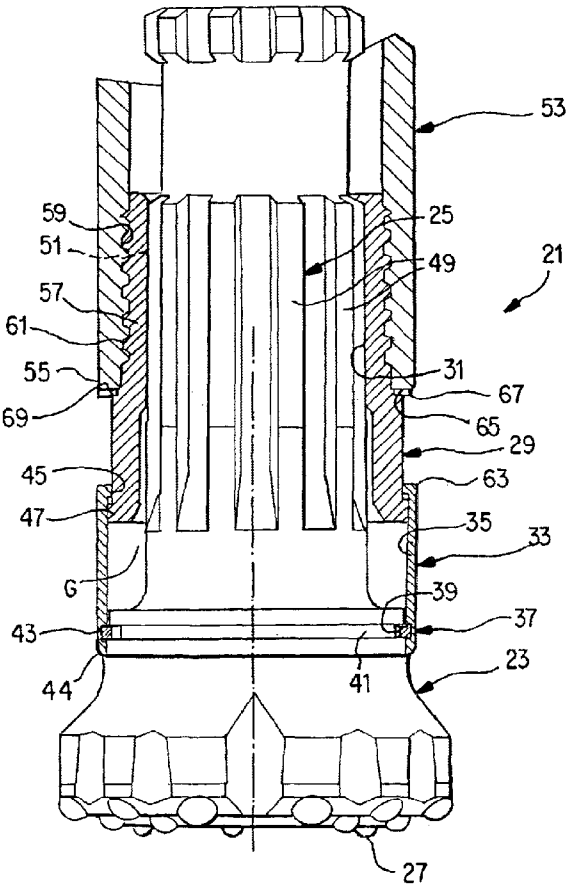
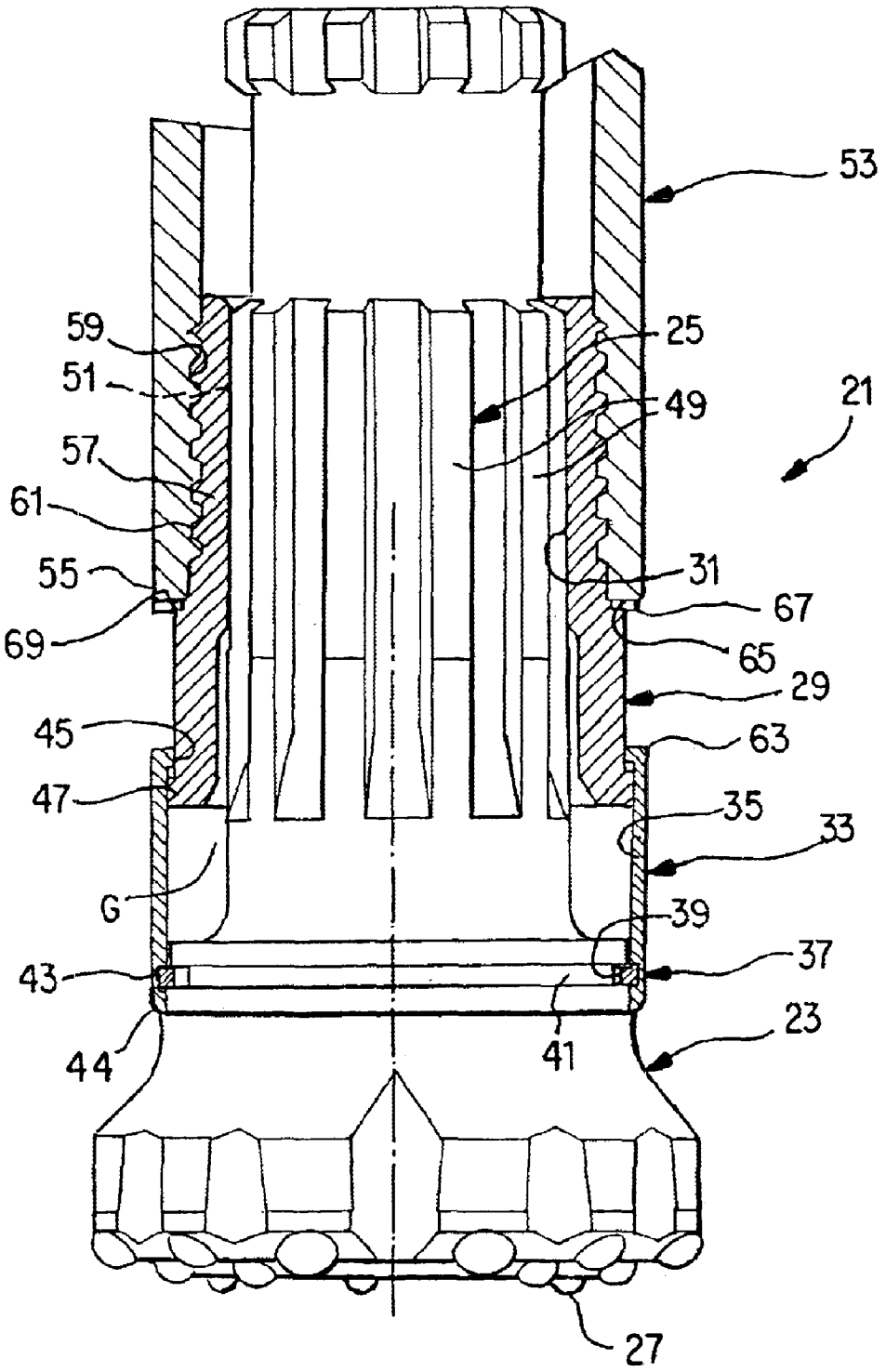
(57) **ABSTRACT**

A bit head retaining system includes a bit head having an upper end and a working face, and a retention sleeve adapted to be connected to an end of a drill casing and having an internal opening in which at least a portion of the bit head above the working face is disposed, the bit head being secured to the retention sleeve so as to be axially immovable relative to the retention sleeve. A method of installing a bit head in a percussion drill is also disclosed.

21 Claims, 1 Drawing Sheet

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BIT HEAD RETAINING SYSTEM AND METHOD OF INSTALLING A BIT HEAD IN A PERCUSSION DRILL

BACKGROUND AND SUMMARY

In earth boring operations involving use of earth boring percussion bits, it is desirable to provide a technique of keeping a bit head connected to a piston case even though the bit head has broken. If the bit head becomes detached from the piston case and is left in the hole, it is necessary to retrieve the bit head from the hole, which can be costly and difficult, and, if retrieval is not possible, it may be necessary to abandon the hole. Various systems have been devised for retaining a broken bit head relative to a piston case. Several of these system are disclosed in U.S. Pat. Nos. 5,065,827, 5,647,447, and 6,070,678, the disclosures of which are incorporated by reference. It is desirable to provide a bit head retention system that will retain a broken bit head relative to a piston case during earth boring operations.

In accordance with an aspect of the present invention, a bit head retaining system includes a bit head having an upper end and a working face, a driver sub having an internal opening in which the upper end of the bit head is axially movable, and a retention sleeve having an internal opening in which at least a portion of the bit head above the working face and at least a portion of the driver sub are disposed, the retention sleeve being axially immovable relative to the bit head.

In accordance with another aspect of the present invention, a bit head retaining system includes a bit head having an upper end and a working face, and a retention sleeve adapted to be connected to an end of a drill casing and having an internal opening in which at least a portion of the bit head above the working face is disposed, the bit head being secured to the retention sleeve so as to be axially immovable relative to the retention sleeve.

In accordance with yet another aspect of the present invention, a method of installing a bit head in a percussion drill includes inserting an upper end of a bit head into an internal axial opening at a first end of a driver sub, sliding a retention sleeve over a second end of the driver sub until an internal recess in the retention sleeve aligns with an external recess in the bit head, securing the bit head relative to the retention sleeve with a retention member disposed in the external recess in the bit head and in the internal recess in the retention sleeve, and attaching the second end of the driver sub to a piston case.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention are well understood by reading the following detailed description in conjunction with the drawing in which like numerals indicate similar elements.

DETAILED DESCRIPTION

As seen in the drawing, a bit head retaining system **21** according to an embodiment of the present invention includes a bit head **23** having an upper end **25** and a working face **27**. A driver sub **29** having an internal opening **31** in which the upper end **25** of the bit head **23** is axially movable is preferably provided. An annular gap G is defined between the driver sub **29** and the upper end **25** of the bit head **23**.

A retention sleeve **33** having an internal opening **35** in which at least a portion of the bit head **23** above the working face **27** and at least a portion of the driver sub **29** are disposed is preferably provided. The retention sleeve **33** is preferably axially immovable relative to the bit head **23**. The retention sleeve **33** is preferably axially movable relative to the driver sub **29**. The retention sleeve **33** preferably completely covers the gap G between the drive sub **29** and the upper end **25** of the bit head **23** so that debris cannot enter the gap.

The retention sleeve **33** is preferably secured to the bit head **23** by a retention arrangement **37**. The retention arrangement **37** preferably includes an internal recess **39** in the retention sleeve **33**, an external recess **41** in the bit head **23**, and a retention member **43** disposed in the internal recess and the external recess. The internal recess **39** in the retention sleeve **33** and the external recess **41** in the bit head **23** are preferably peripheral grooves extending around an entire periphery of the retention sleeve and the bit head. The retention member **43** is preferably adapted to be compressed into the external recess **41** in the bit head, or, if desired or necessary, expanded into the internal recess **39** in the retention sleeve **33**, to permit a first end **44** of the retention sleeve to axially slide over the bit head so that the internal recess in the retention sleeve and the external recess in the bit head are aligned. The retention member **43** is preferably a split ring. The retention sleeve **33** and the bit head **23** are preferably rotatable relative to each other.

The retention sleeve **33** preferably includes an internal flange **45** and the driver sub **29** preferably includes an external flange **47** that limit axial movement of the retention sleeve relative to the driver sub. More particularly, the flanges **45** and **47** preferably limit the downward movability, i.e., toward the working face **27** of the bit head **23**, of the retention sleeve **33** relative to the driver sub **29**. The retention sleeve **33** is preferably rotatable relative to the driver sub **29**.

The upper end **25** of the bit head **23** preferably has external splines **49** and the driver sub **29** preferably has internal splines **51** that correspond to the external splines so that the bit head is axially movable but not rotatable relative to the driver sub. A piston case **53** preferably has an end portion **55** to which a second end **57** of the driver sub **29** is secured. The end portion **55** of the piston case **53** preferably has internal threads **59**, and the driver sub **29** preferably has external threads **61** by its end **57**. The driver sub **29** is preferably attached to the end portion **55** of the piston case **53** by the external threads **61** of the driver sub mating with the internal threads **59** of the end portion, whereby the piston case **53** and the driver sub **29** together form a tubular structure.

The retention sleeve **33** is preferably axially movable relative to the driver sub **29** such that the internal flange **45** is movable downwardly to a point at which the internal flange contacts the external flange **47** of the driver sub **29** and upwardly to a point at which the top end **63** of the retention sleeve contacts an end face **65** of the piston case **53** or, preferably, a wear ring **67** disposed between the end face of the piston case and a surface of a ledge **69** on the driver sub **29**. Contact between the end face **65** and the ledge **69**, or between the end face, the wear ring **67**, and the ledge preferably limits an amount that the driver sub **29** can extend into the piston case **53**.

The bit head retaining system **21** is well-suited for installation on new piston cases **53** or for retrofits on existing piston cases. To install a bit head **23** in a percussion drill having a piston case **53**, the upper end **25** of the bit head is inserted into the internal axial opening **31** at a first end of the

driver sub **29**. The retention sleeve **33** is slid over a second end of the driver sub **29** until the internal recess **39** in the retention sleeve aligns with the external recess **41** in the bit head **23**. The bit head **23** is secured relative to the retention sleeve **33** with a retention member **43** disposed in the external recess **41** in the bit head **23** and in the internal recess **39** in the retention sleeve. The second end **57** of the driver sub **29** is attached to the piston case **53** by a suitable attachment technique, such as by external threads **61** on the second end of the driver sub mating with internal threads **59** on the end portion **55** of the piston case. The bit head **23** is preferably secured relative to the retention sleeve **33** so that the bit head is axially immovable relative to the retention sleeve, yet is rotatable relative to the retention sleeve.

While this invention has been illustrated and described in accordance with a preferred embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

What is claimed is:

1. A bit head retaining system, comprising:

a bit head having an upper end and a working face;

a piston case and a driver sub disposed above the working face, the driver

sub connected to a lower end of the piston case to form therewith a tubular structure, the driver sub having an internal opening in which the upper end of the bit head is axially movable; and

a retention sleeve having an internal opening in which at least a portion of the bit head above the working face and at least a portion of the driver sub are disposed, the retention sleeve being axially immovable relative to the bit head, wherein an upper portion of the retention sleeve is axially movable relative to the tubular structure, and the tubular structure includes a stop structure limiting the downward axial travel of the retention sleeve relative to the tubular structure.

2. The bit head retaining system as set forth in claim **1**, wherein the retention sleeve is secured to the bit head by a retention arrangement.

3. The bit head retaining system as set forth in claim **2**, wherein the retention arrangement includes an internal recess in the retention sleeve, an external recess in the bit head, and a retention member disposed in the internal recess and the external recess.

4. The bit head retaining system as set forth in claim **3**, wherein the retention member is a split ring.

5. The bit head retaining system as set forth in claim **1**, wherein the retention sleeve includes an internal flange and the driver sub includes an external flange that defines the stop structure that limits the downward axial movement of the retention sleeve relative to the tubular structure.

6. The bit head retaining system as set forth in claim **1**, wherein the upper end of the bit head has external splines and the driver sub has internal splines that correspond to the external splines.

7. The bit head retaining system as set forth in claim **1**, wherein the piston case has an end portion with internal threads, and wherein the driver sub has external threads, the external threads of the driver sub mating with the internal threads of the end portion.

8. The bit head retaining system as set forth in claim **1**, wherein the stop structure is disposed on the piston case.

9. The bit head retaining system as set forth in claim **8**, wherein a bottom end of the piston case possesses the stop structure, and further comprising a wear ring disposed at the bottom end of the piston case to prevent direct contact between the retention sleeve and the piston case.

10. The bit head retaining system as set forth in claim **1**, wherein the retention sleeve covers an axial gap defined between the driver sub and the bit head.

11. The bit head as set forth in claim **1**, wherein the bit head is rotatable relative to the retention sleeve about a center axis of the retention sleeve, the retention sleeve being axially immovable relative to the bit head in all rotational positions of the bit head relative to the retention sleeve.

12. A bit head retaining system, comprising:

a bit head having an upper end and a working face; and

a retention sleeve adapted to be connected to an end of a drill casing and having an internal opening in which at least a portion of the bit head above the working face is disposed, the bit head being secured to the retention sleeve so as to be axially immovable relative to the retention sleeve, wherein the bit head is rotatable relative to the retention sleeve about a center axis of the retention sleeve, the bit head being axially immovable relative to the retention sleeve in all rotational positions of the bit head relative to the retention sleeve.

13. The bit head retaining system as set forth in claim **12**, wherein the retention sleeve includes an internal recess and the bit head includes an external recess, and the bit head is secured to the retention sleeve by a retention member disposed in the internal recess and the external recess.

14. The bit head retaining system as set forth in claim **13**, wherein the retention member is a split ring.

15. The bit head retaining system as set forth in claim **12**, wherein an upper end of the retention sleeve includes an internal ledge for connecting the retention sleeve to an end of a drill casing.

16. A method of installing a bit head in a percussion drill, comprising:

inserting an upper end of a bit head into an internal axial opening at a first end of a driver sub;

sliding a retention sleeve over a second end of the driver sub until an internal recess in the retention sleeve aligns with an external recess in the bit head;

securing the bit head relative to the retention sleeve with a retention member disposed in the external recess in the bit head and in the internal recess in the retention sleeve; and

attaching the second end of the driver sub to a piston case, wherein the piston case and the driver sub together form a tubular structure, and

attaching the retention sleeve to the tubular structure.

17. The method as set forth in claim **16**, wherein the retention member is a split ring.

18. The method as set forth in claim **16**, wherein the bit head is secured relative to the retention sleeve so that the bit head is axially immovable relative to the retention sleeve.

19. The method as set forth in claim **18**, wherein the bit head is secured relative to the retention sleeve so that the bit head is rotatable relative to the retention sleeve.

20. The method as set forth in claim **19**, wherein the retention sleeve is axially immovable relative to the bit head in all rotational positions of the bit head relative to the retention sleeve.

21. The method as set forth in claim **18**, wherein the bit head is axially movable relative to the tubular structure, the tubular structure including a stop structure for limiting axial movement of the retainer sleeve relative to the tubular structure.

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